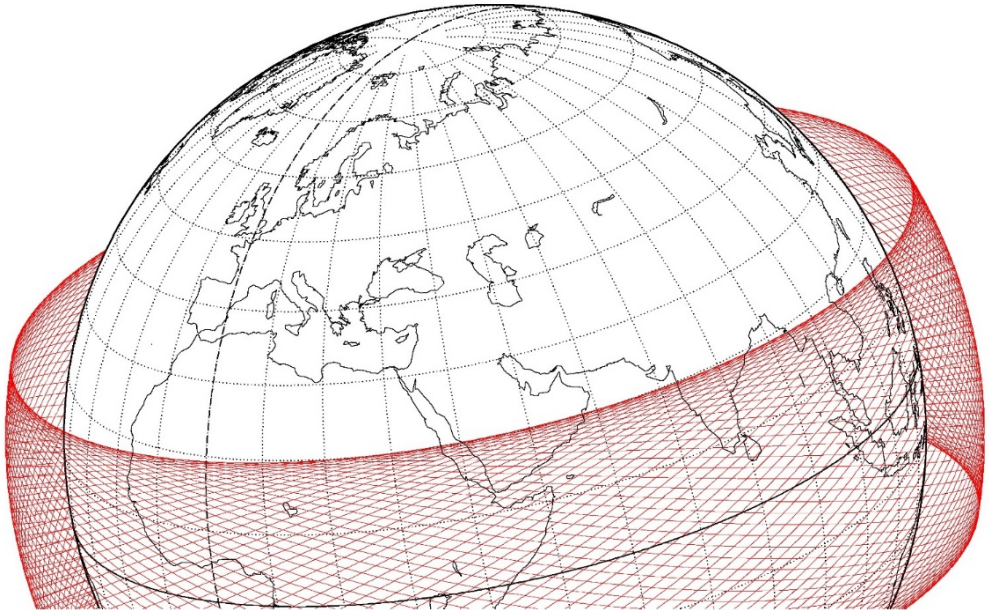
Status of the Megha-Tropiques mission

Precipitation related activities



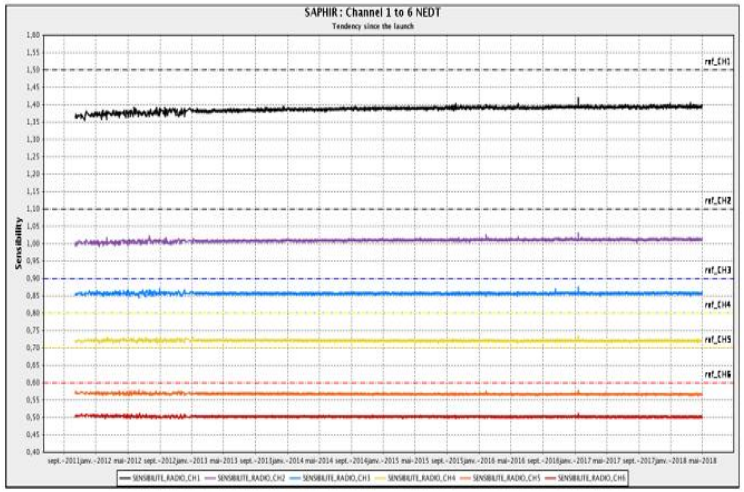
Rémy Roca, CNRS/LEGOS, Toulouse (roca@legos.obs-mip.fr)
P Chambon, M Gosset, R. Juca, T. Fiolleau
and the french scientists from the Megha-Tropiques team

Outline of the presentation

- SAPHIR status
- Assimilation of SAPHIR at NWP centers
- The TAPEER product
- Mesoscale Convective Systems
- Conclusions and outlook

Saphir Instrument monitoring

7 years this week !



Courtesy M. DEJUS - CNES

SAPHIR fully operational after 7 years.

Instrument in perfect heath, no drift, no attrition

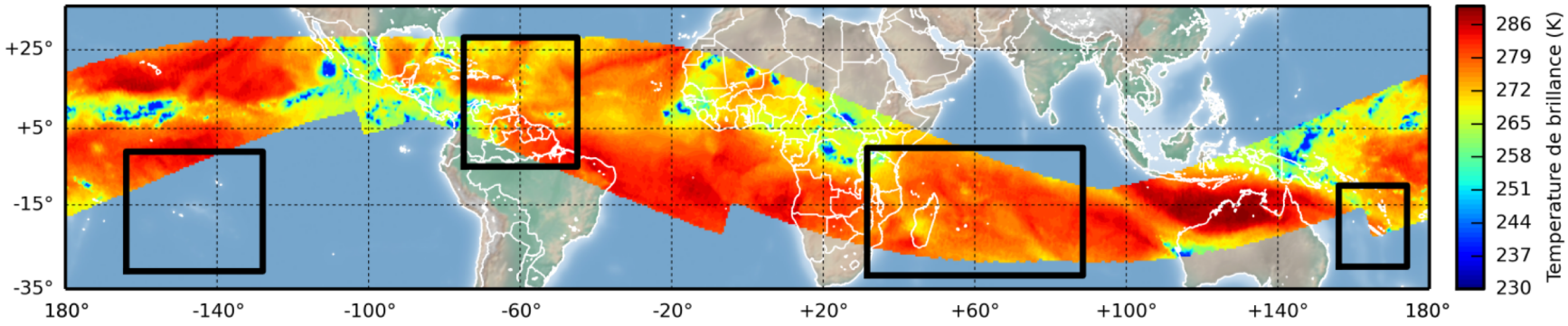
the mechanism have reached more than 136 millions rotations

About 180 parameters are controlled daily with no warning so far

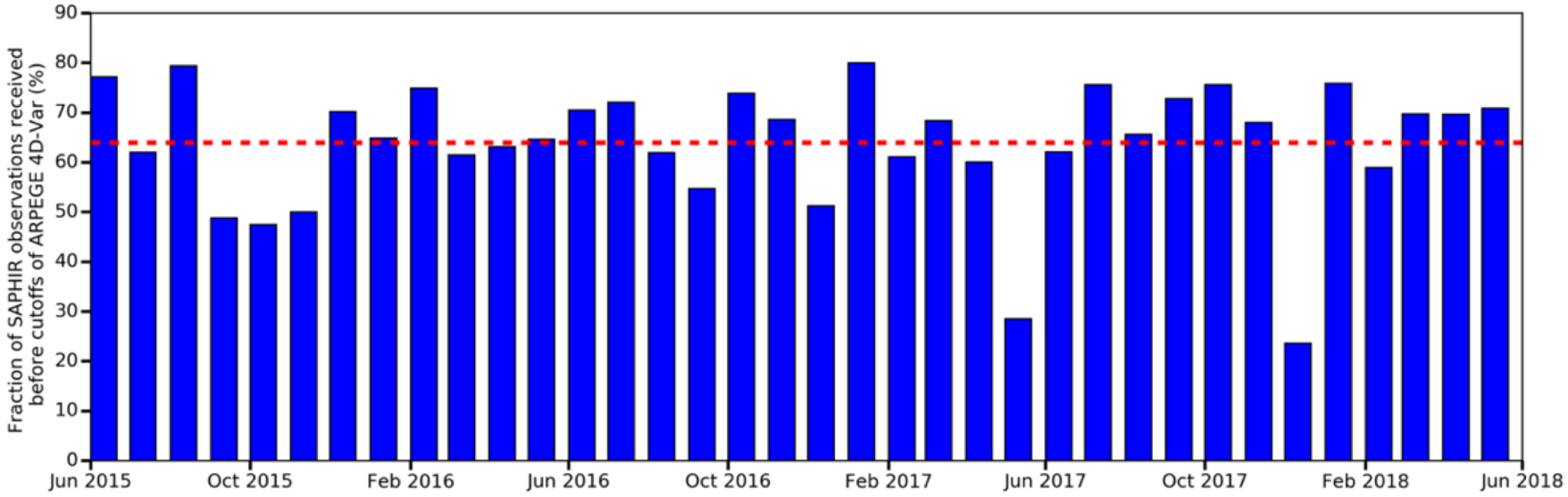
The community of users is growing and there are welcome

Assimilating SAPHIR at NWPS

NRT Stream via EUMETCast since Summer 2014



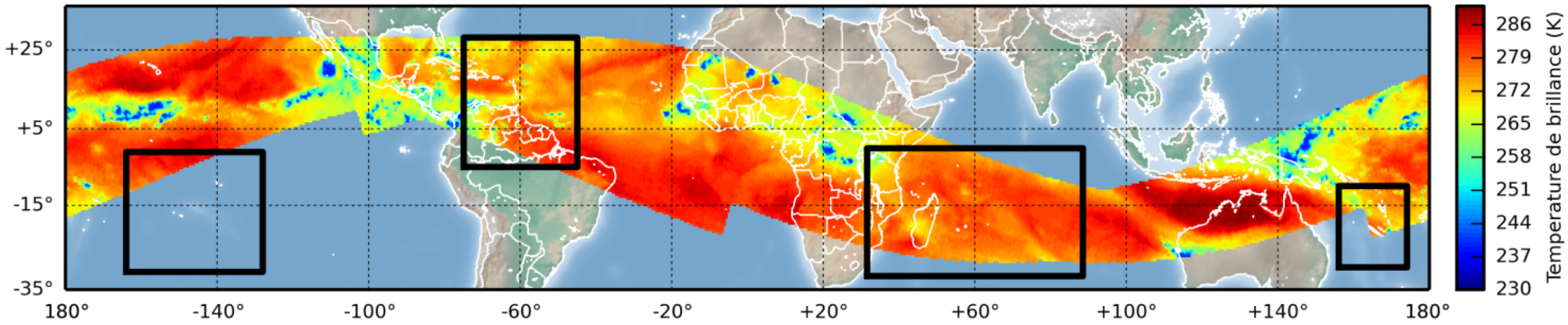
Courtesy P. Chambon



Fraction of SAPHIR observations per month which have been received and used at Météo-France before the cutoff times of the Météo-France global data assimilation system (**4 to 5 hours** depending on the assimilation cycle)
(Courtesy of Hervé Benichou, Météo-France, DIROP/COMPAS/COM).

Assimilating SAPHIR at NWPS

NRT Stream via EUMETCast since Summer 2014

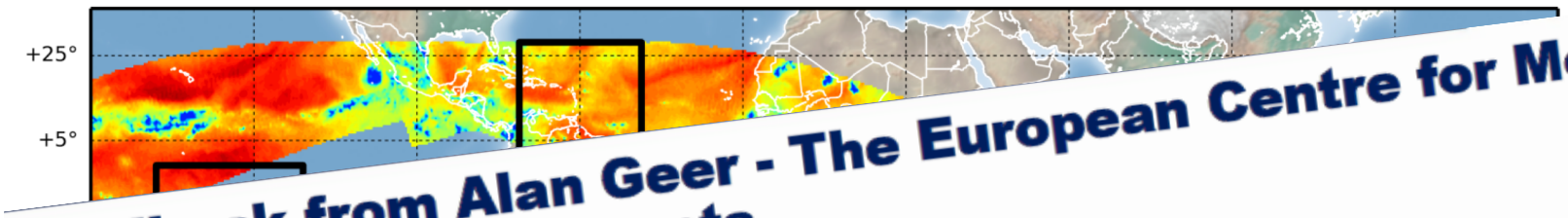


Courtesy P. Chambon

- **Operational Assimilation**
  - **Météo-France since 13 April 2015**
    - Global model ARPEGE
    - Regional model ALADIN Réunion
  - **NCMRWF** since March 2014
    - GFS model
  - **SAC Ahmedabad**
    - WRF based forecast system
  - **JMA**
  - **US NAVY**
  - **JCSDA**
  - **NCEP**
  - **UK MET Office**
  - **ECMWF total sky radiance (joint effort with Météo-France by PChambon)**
  - **KMA Since November 2017**

Assimilating SAPHIR at NWPS

NRT Stream via EUMETCast since Summer 2014



Feedback from Alan Geer - The European Centre for Medium-Range Weather Forecasts

Dear Michel,

Thanks for this opportunity, and for all the work that goes into getting SAPHIR data to us.

One key issue for feedback is the NRT data availability. For example we could only receive ~81% of SAPHIR data during the January to June 2015 period, ~65% for winter 2015/2016, and use of ~70% for the summer 2016 (apologies but I don't have more recent statistics to hand). This leve of availability provides the same coverage as 2-3 polar orbiting MHS instruments in the tropics, which is already an excellent result for a researc mission. However, if it were possible to get a more reliable NRT data provision, SAPHIR would be providing the equivalent of 3-4 MHS and its benefits could be enhanced even further.

Another issue (with the instrument design) would be the lack of a colocated lower-frequency window channel (e.g. a 90 or 118 GHz channel) f computing scattering indices to detect ice cloud, and for surface emissivity retrievals, although the tech. memo. describes how it has been reasonably straightforward to work around these issues.

But despite these small issues it's been a very useful addition to the observing system and it provides good benefits to tropical forecasts, so v are very happy with it overall.

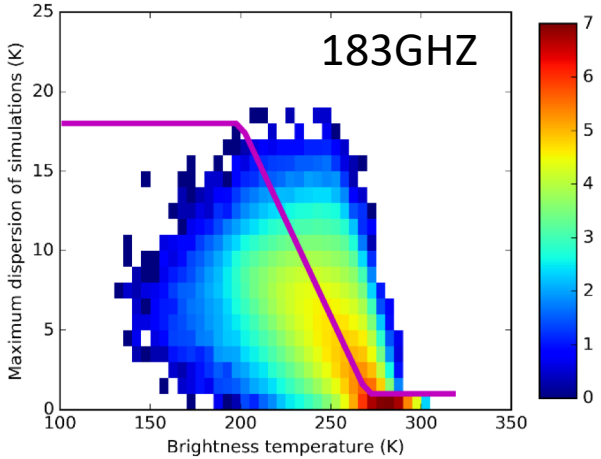
Best regards,
Alan

- **…y radiance (joint effort with Météo-France by P Chambon)**
- **KMA Since November 2017**

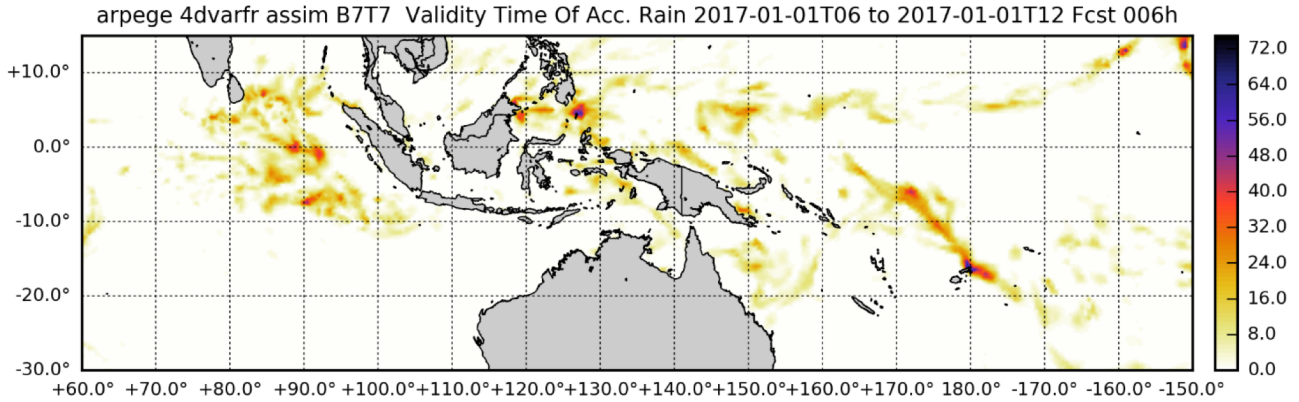
Assimilating SAPHIR in total sky

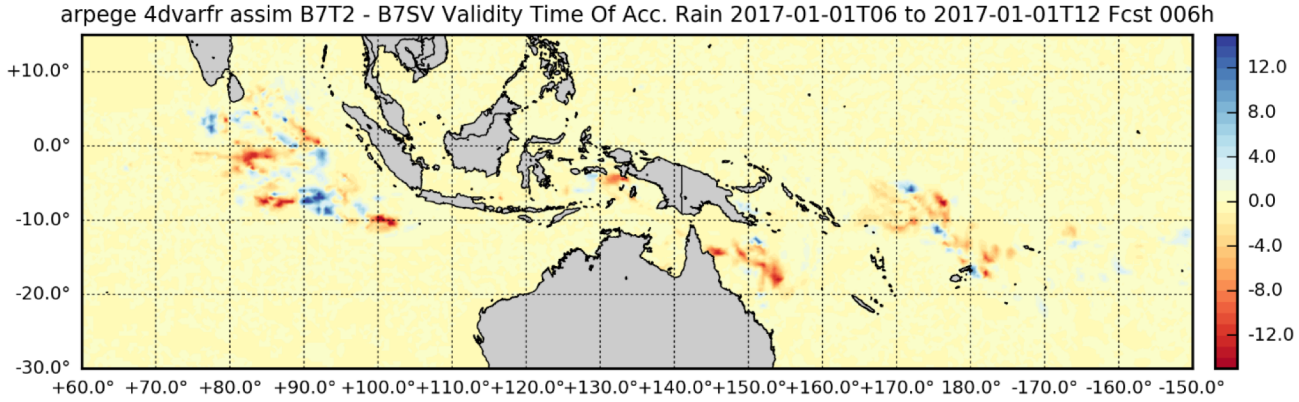
Improvements in wind, temp, moisture and … rainfall forecasts

Error model for Rad Transfer



Duruisseau et al., 2018 in revision





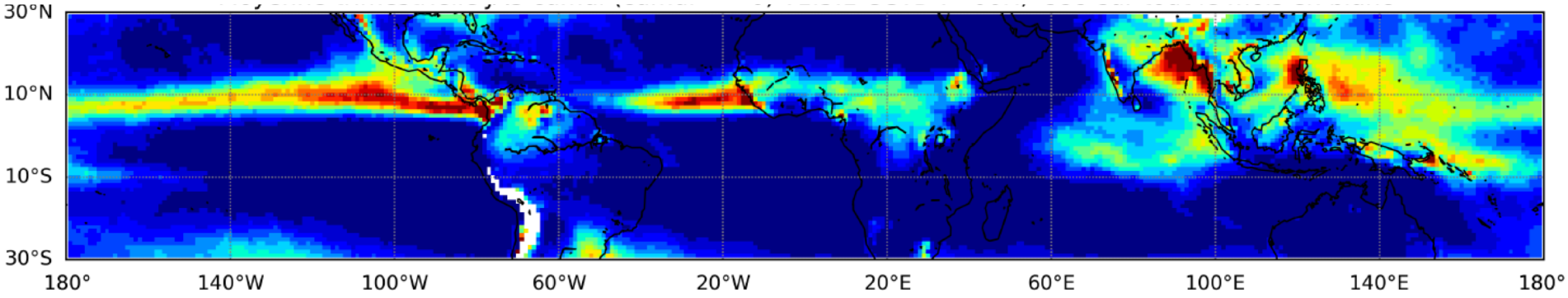
See POSTER by Phil Chambon et al

TAPEER1.5 has been released !

released since June 2017

1°X1° X 1day accumulated precipitation + estimates of the uncertainty
All GEO IR data

TMI, AMSR2, SSMI F15, SSMIS F16, F17, F18
SAPHIR detection only



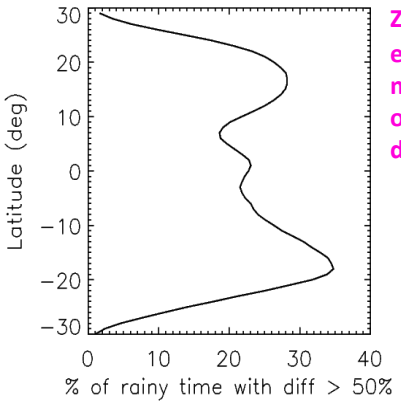
TAPEER1.5-BRAIN- / Jul-Sep seasonal average /2012-2016 mean

Available at http://www.icare.univ-lille1.fr/mt

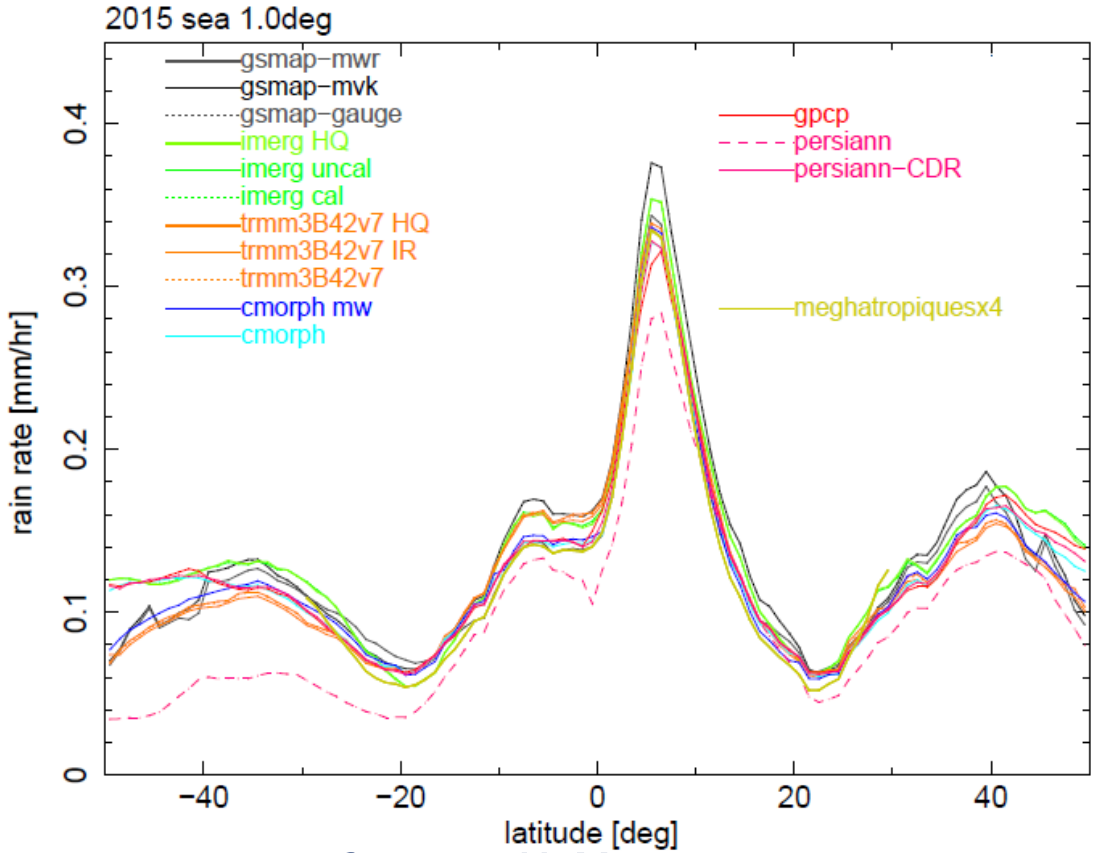
TAPEER1.5

Performances

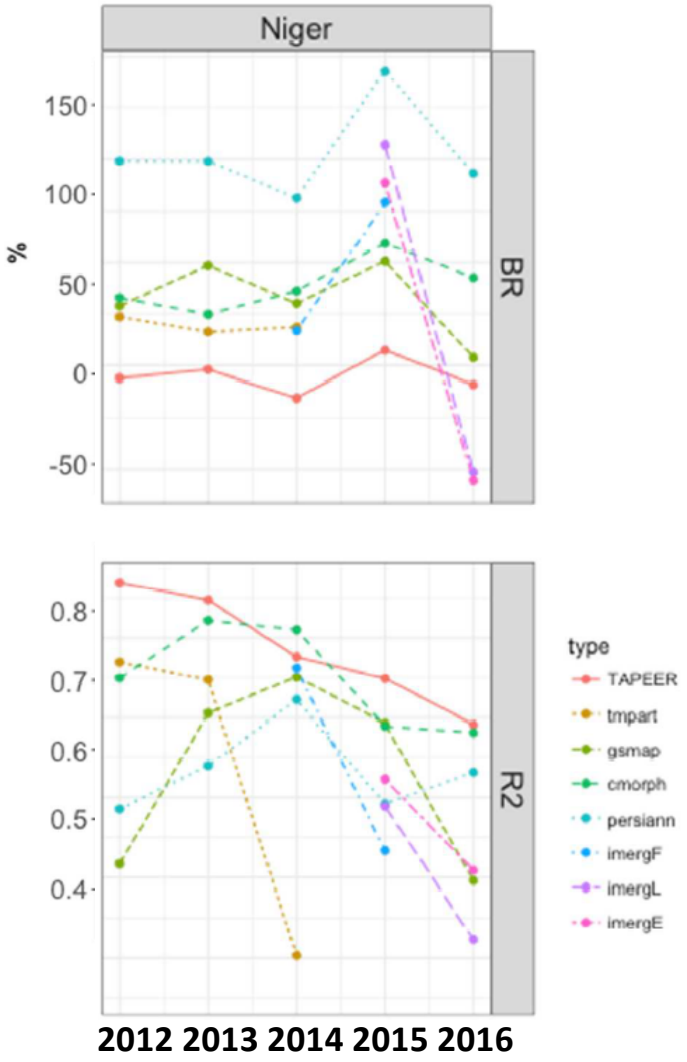
Roca et al., 2018, QJRMS



Zonal mean of the for which the No SAPHIR experiment differs from the baseline product by more than 50% of the daily accumulation number of days normalized by the total number of rainy days.



Courtesy H. Masunaga

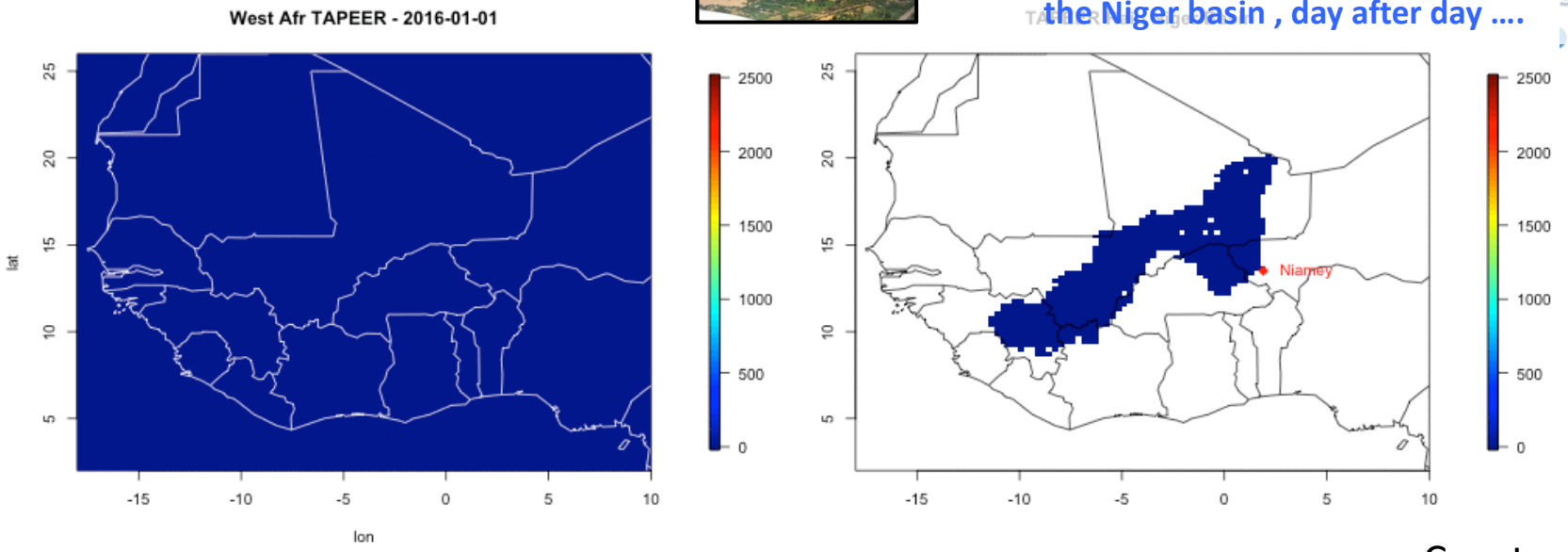


Gosset et al., 2018, QJRMS

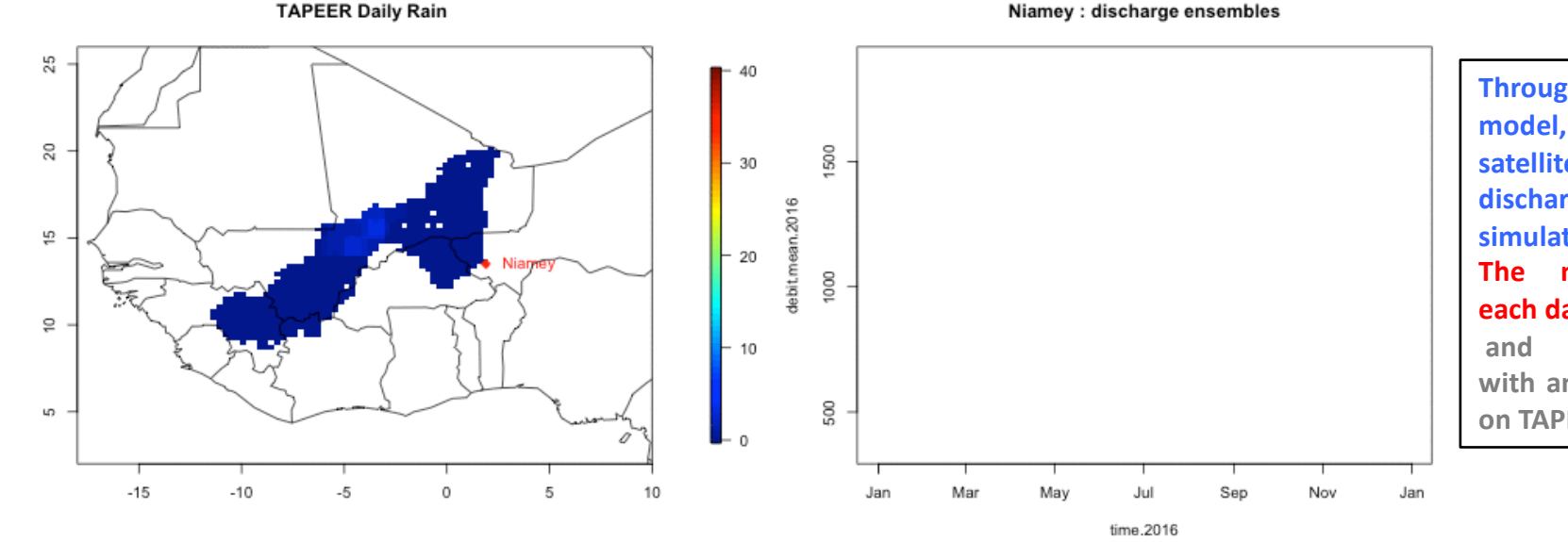
TAPEER1.5

Hydrolological applications

Rainfall is accumulating over the Niger basin , day after day ….



Courtesy M. Gosset



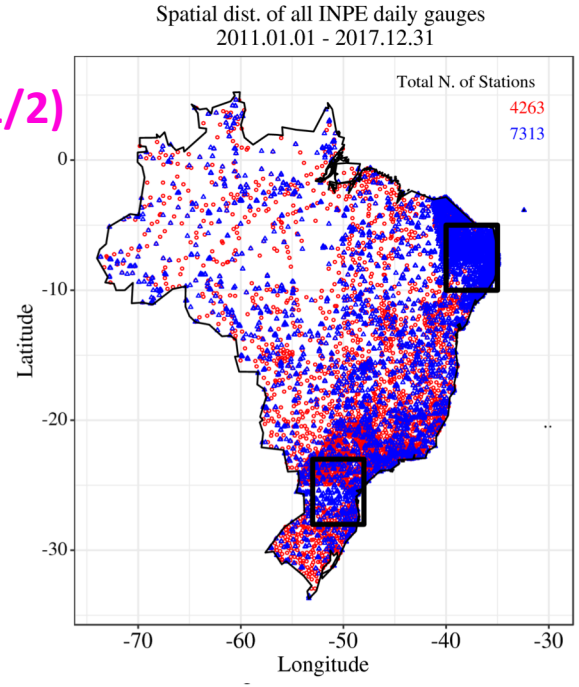
Through a hydrological model, forced by the satellite rainfall the discharge in Niamey is simulated :

The mean prediction each day

and the uncertainty with an ensemble based on TAPEER error bar.

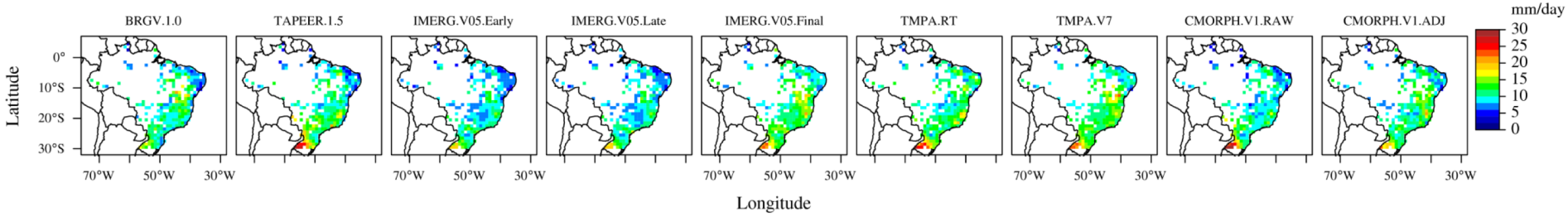
TAPEER1.5

On going evaluation over Brazil (1/2)

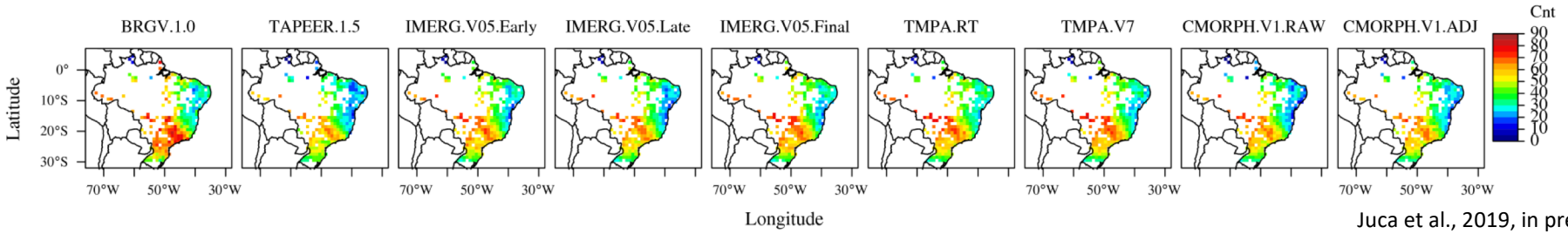


Courtesy Romulo Juca

Daily (1200-1200 UTC) Rainfall Mean - Conditional (th=1mm/day)
2015.12.01 - 2016.02.29



Daily (1200-1200 UTC) N. of Rainny days - Conditional (th=1mm/day)
2015.12.01 - 2016.02.29

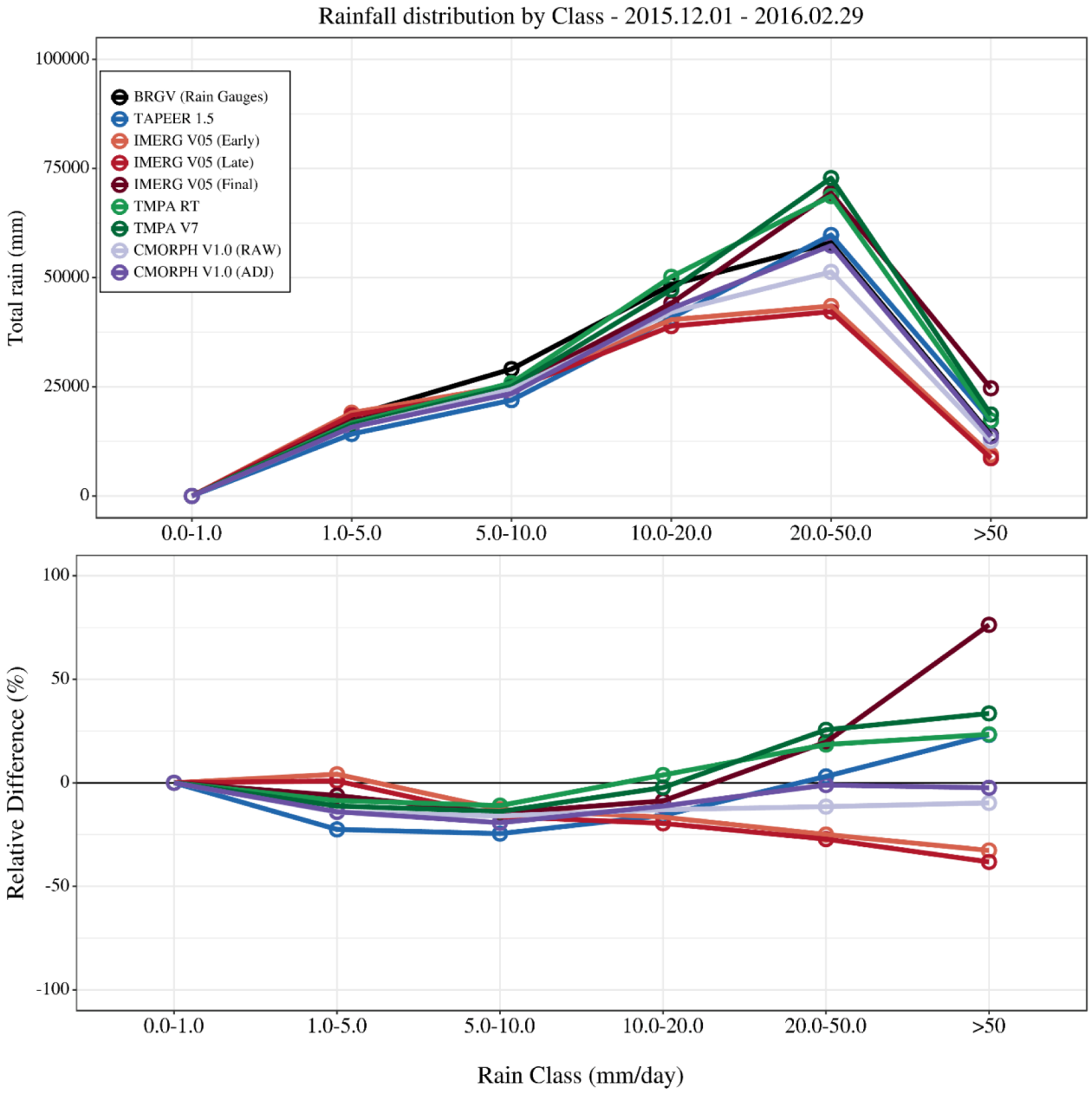


Juca et al., 2019, in prep

TAPEER1.5

On going evaluation over Brazil (2/2)

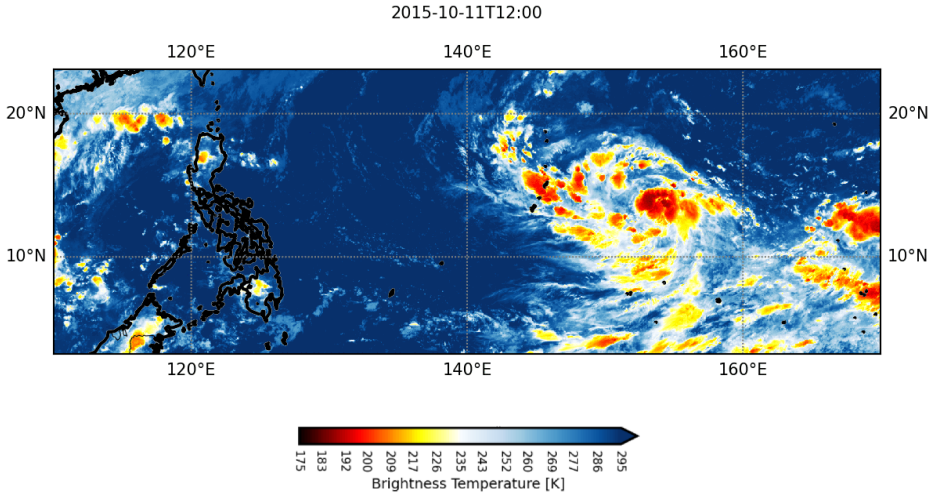
Courtesy Romulo Juca

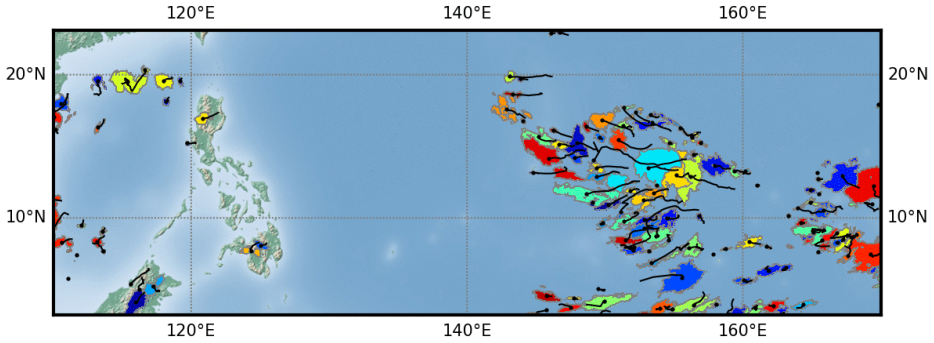


Juca et al., 2019, in prep

Mesoscale Convective Systems

A new database using the TOOCAN algorithm





Courtesy Thomas Fiolleau

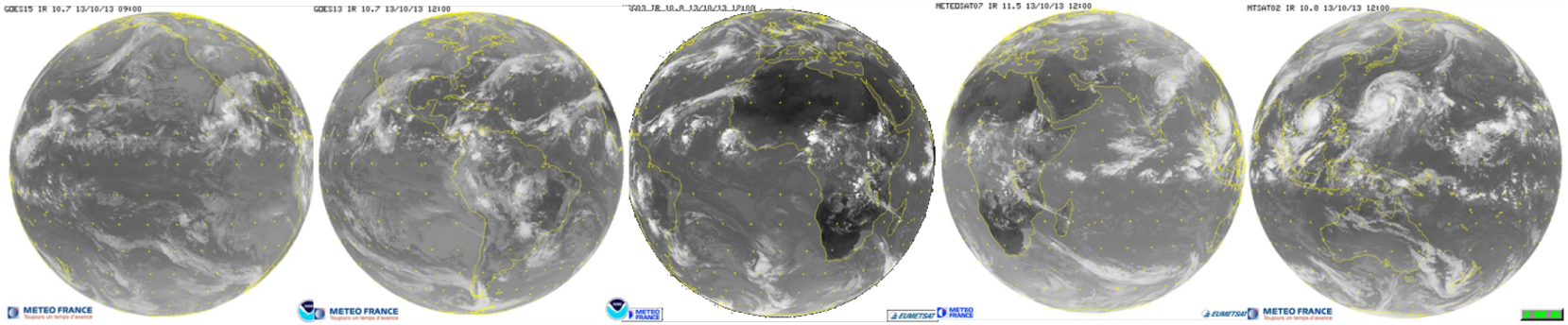
Fiolleau T. and R. Roca, (2013), An Algorithm For The Detection And Tracking Of Tropical Mesoscale Convective Systems Using Infrared Images From Geostationary Satellite, Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2012.2227762.

Mesoscale Convective Systems

A new database using the TOOCAN algorithm

- 2012-2016
- 0.04°x0.04°
- Homogenized calibration

GOES-15 (4km - 30min) | GOES-13 (4km - 30min) | MSG-1/2/3 (3km - 30min) | MET-7 (5km - 30min) | MTSAT-1/2/HIMAWARI (4km/2km - 30min)



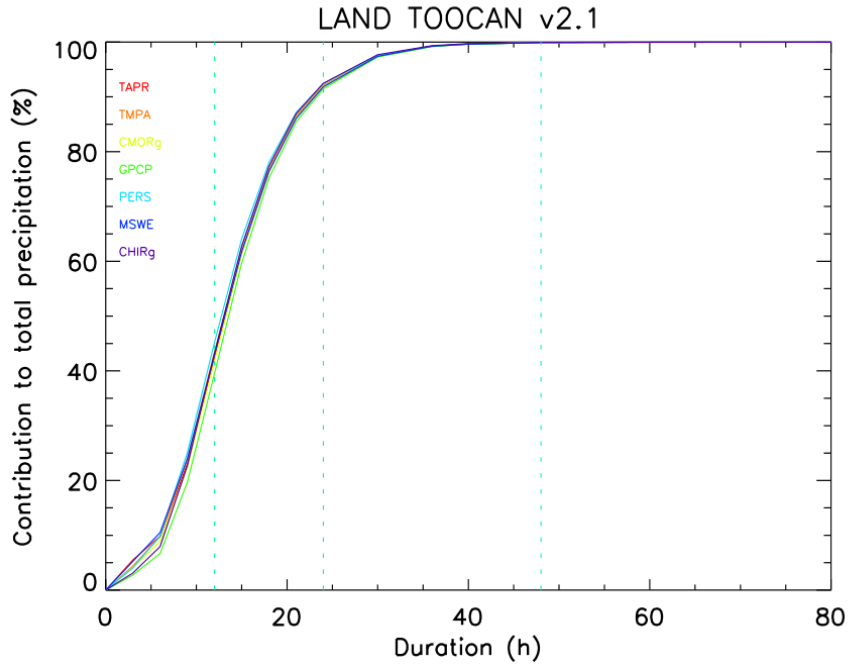
Platform	Nadir location	Instrument	Central wavelength	Spectral interval	Spatial resolution at nadir	Temporal resolution	Tracking region	Source
GOES-15	135°W	IMAGER	10,7 µm	10,2 µm - 11,2 µm	4km	30 min	180°W-105°W ; 40°S-40°N	NOAA / DWD
GOES-13	75°W	IMAGER	10,7 µm	10,2 µm - 11,2 µm	4km	30min	111°W-30°W ; 40°S-40°N	NOAA / DWD
METEOSAT-8/9/10	0°	SEVIRI	10,8 µm	9,8 µm - 11,8 µm	3km	15min	45°W-45°E ; 40°S-40°N	EUMETSAT/ CMS/ICARE
METEOSAT-7	57,5°E	MVIRI	11,5µm	10,5 µm - 12,5 µm	5km	30min	12°E-107°E ; 40°S-40°N	EUMETSAT/ Climserv
MTSAT-2	145°E	IMAGER	10,8 µm	10,3 µm - 11,3 µm	4km	30min	95°E-170°W ; 40°S:0°N	CMS/ICARE CIMSS
HIMAWARI-8	140,7°E	AHI	10,45 µm	10,15 µm - 10,75 µm	2km	10min	94°E-170°W ; 40°S:40°N	CMS/ICARE JMA

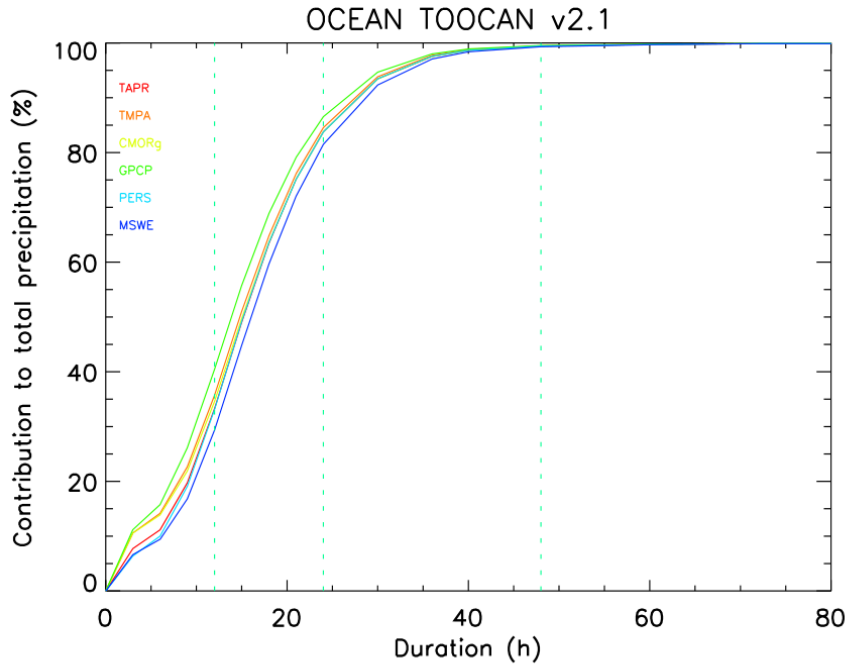
See POSTER by Thomas Fiolleau et al

Mesoscale Convective Systems

Exploring the role of MCS to the precipitation distribution

2012-2016 30°s-30°n





Update from Roca et al., 2014 J Climate

- The systems lasting up to 12h only explains
  - 30 % of the rainfall over ocean
  - 40% over land
- Robust to the selection of the satellite products
- TAPEER use no gauges

Summary of the activity

7 years and still young as day 1

- The SAPHIR instrument is brand new like
- Data available in RT for assimilation etc…
- French 1°X1°-1 data constellation product released
  - Very good performances
  - on going evaluation over various tropical continents

- New database about MCS to be soon released (early next year)

and remember, use this reference !

Roca et al, **2015** The Megha-Tropiques mission: a review after three years in orbit, Front. Earth Sci., 3, 1–14, doi:10.3389/feart.2015.00017, 2015.